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(54) Process for milling cereals such as wheat and maize, and the relative plant.

(57) A cereal milling process and plant are proposed in which the finished products are obtained essentially by grain breaking operations performed by roll mill (11) and suitable centrifugal impact mill (17), separation operations performed by suitable pneumatic separators (18), and further milling operations performed by centrifugal impact mills (27, 42) and roll mills (35, 37, 46).

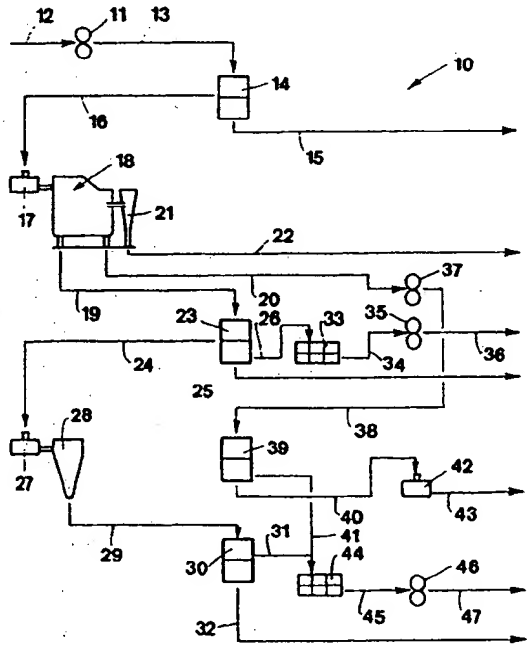

fig 1

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PROCESS FOR MILLING CEREALS SUCH AS WHEAT AND MAIZE, AND THE RELATIVE PLANT

1. Field of the invention

This invention relates to a process for milling cereals, particularly wheat and maize, by which finished products such as flour and bran are obtained from crude products in the form of grains.

The invention also relates to the plant for implementing said process.

2. Prior art

Current milling systems are designed to separate the various component parts of the grain or caryopsis of wheat or maize, and mainly to separate the four from the cortical fractions or bran. In traditional mills the milling is accomplished by gradual disintegration of the crude products in grain form by a rather complicated assembly of machines forming the milling scheme.

Generally the milling scheme comprises various stages, each of which requires a series of machines comprising essentially roll mills, plansifters and purifiers.

The size reduction operations in the mills are separated by screening in the plansifters and selection in the purifiers.

Roll mills are machines provided substantially with one or more pairs of cast iron or steel rolls with smooth or knurled surfaces. By rotating in opposite directions at different speeds, the rolls break, crush and squeeze the products while simultaneously slitting the cortical fractions to separate them from the floury fraction. The rolls differ according to the function which they perform, ie breaking, separation or size reduction.

The purpose of the breaking rolls is to open the grains of wheat or maize and detach the farinaceous endosperm from the cortical fraction, leaving this latter in the form of large-dimension flakes separable by the plansifters.

That semifinished material which is rejected because still too coarse is passed to a further breaking operation in a subsequent mill.

The separation mills, which receive the coarse fractions still joined to bran fractions, separate the semolina from the bran and feed the purifiers.

The reduction mills reduce the particle size of the semolina fractions now free or nearly free of bran fractions, to produce increasingly fine semolina and flour.

The plansifters are flat screens which dimensionally classify the products from the roll mills and feed the subsequent roll mills and the purifiers.

They generally consist of two twin bins, each of which contains a series of overlying frames which support screens of different mesh sizes.

The two bins are suspended elastically and are rotated at a certain speed so that by centrifugal force the fine particles are projected outwards through the screens and are divided into batches of different particle size.

The purifiers separate the particles both by size, using vibrating screens, and by specific gravity, by means of an upward air stream which entrains and suspends the lighter bran flakes to separate them from the heavier semolina.

The purifiers can themselves feed breaking, separation and reduction mills with the different batches of material obtained.

Thus, within each stage of the milling scheme, mechanical breaking, crushing and squeezing operations are effected by roll mills, and/or screening and classification operations by the plansifters and purifiers, to obtain finished products which are collected, and semifinished products which are further processed in the subsequent stages.

Generally, flour is obtained in each stage, bran also being collected in the final stages.

In the mill house the various machines are grouped on the various floors according to type, the batches of semifinished products which move through one or more stages travelling either in downwardly directed streams by gravity fall, or in upwardly directed streams by a pneumatic system comprising a compressor or fan unit, a bank of cyclones, connection piping and filters for recovering small flour particles present in the air leaving the mill.

The process and plant of a traditional mill are therefore very complex by virtue of the large number of machines used and the large number of product streams, which form the milling scheme.

Moreover, the production cycle is rather long because a number of successive processing stages are required to obtain the most refined finished products.

All this contributes to high production costs and considerable energy consumption.

Centrifugal impact mills are known, for example from Italian patent applications Nos. 12442 A/87 and 15142 B/87, which reduce the product particle size by the impact of particles entrained in a fluid stream with each other and against suitable surfaces.

With centrifugal impact mills the final product quality is not penalised because of avoidance of high temperature increase and break-down of the cereal components, ie starches and proteins, which is typical of the pressure crushing implemented by

roll mills.

Pneumatic centrifugal separators are also known which effectively select the components of milling products on the basis of their specific gravity, such as those described in Italian patents Nos. 1,171,172 and 1,157,470.

3. Summary of the invention

An object of the present invention is a milling process which requires a smaller number of operations and is therefore more simple and rapid than traditional processes, and which ensures the quality of the final products.

A further object of the invention is to provide a milling process by which plant and production costs are reduced.

A further object of the invention is to provide a plant for implementing said process.

According to the invention, a process for milling cereals such as wheat and maize has been developed comprising a breaking operation on the crude products in the form of grains, to obtain first semifinished products and first finished products, the process being characterised by comprising at least one impact milling operation to reduce the particle size of said first semifinished products, at least one pneumatic separation operation for separating the components of said first semifinished products on the basis of their specific gravity to obtain at least second semifinished products, and at least one further milling operation to reduce the particle size of said second semifinished products to obtain at least second finished products.

According to a preferred embodiment, said process is implemented in a plant comprising a breaking roll mill for the crude products in the form of grains, to provide first semifinished products and first finished products, the plant being characterised by comprising at least one centrifugal impact mill arranged to reduce the particle size of said first semifinished products, and at least one pneumatic separator arranged to divide the components of said first semifinished products on the basis of their specific gravity, to obtain at least second semifinished products, the plant also comprising at least one further mill arranged to reduce the particle size of said second semifinished products, to provide at least second finished products.

With the described milling process and plant, the different component parts of wheat or maize grains can be separated to obtain flour and bran with maximum yield, while simultaneously accomplishing a substantial shortening of the production cycle and eliminating numerous machines, particularly roll mills.

Thus the advantages of a reduction in plant and production costs are obtained, together with quality improvements in the final products.

4. Detailed description of the invention

Characteristics and advantages of the invention are described hereinafter with reference to the accompanying figure, which shows a preferred embodiment of the invention by way of non-limiting example.

In the figure the reference numeral 10 indicates overall a plant for milling cereals, particularly wheat or maize.

11 indicates a breaking roll mill and 12 and 13 indicate its entry and exit respectively.

14 indicates a plansifter and 15 and 16 indicate a first and second exit thereof.

17 indicates a centrifugal impact mill for example as described in Italian patent applications Nos. 12442 A/87 and 15142 B/82, and 18 indicates overall a unit comprising two pneumatic separators such as that described in Italian patent No. 1171172.

21 indicates a cyclone separator and 22 its exit.

23 indicates a plansifter and 24, 25, 26 its exits. 27 indicates a centrifugal impact mill, 28 indicates a pneumatic separator and 29 its exit.

30 indicates a plansifter and 31 and 32 its exits. 35 indicates a reduction roll mill and 36 its exit.

37 indicates a separation roll mill and 38 its exit; 39 indicates a plansifter and 40 and 41 its exits.

42 indicates a centrifugal impact mill and 43 its exit.

44 indicates a purifier and 45 its exit; 46 indicates a reduction roll mill and 47 its exit.

The suitably cleaned crude product in the form of wheat or maize grains enters the roll mill 11 where the grains are broken. The first semifinished products leaving it are screened, ie dimensionally classified, in the plansifter 14, from the exit 15 of which coarse flours are obtained as first finished products, the remaining semifinished products flowing through the line 16 to the centrifugal mill 17, to then enter the unit 18.

In the centrifugal mill 17 the first semifinished products are subjected to impact milling, the product components being reduced and selected in the unit 18, which is formed from two pneumatic separators such as that described in the patent 1,171,172.

In the unit 18 second and third semifinished products are classified and leave through the exits 19 and 20 respectively. The finished products are collected in the cyclone 21 and leave through the exit 22.

The coarser semifinished products leaving through the exit 19 are screened and dimensionally

classified in the plansifter 23. Finished products leave through the exit 25 of the plansifter 23, while semifinished products leave through the exit 26 and are separated in the purifier 33 on the basis of their size and specific gravity, to then be subjected to particle size reduction in the reduction roll mill 35, after which they leave through the exit 36 as finished products in the form of very fine flours.

The other second semifinished products leaving the plansifter 23 through the exit 24 enter a centrifugal impact mill 27 and then enter the centrifugal disintegrator 28, which further reduces the particle size of said products to provide fourth semifinished products.

The mill 27 is preferably a micronizer, such as that described in patent applications Nos. 12442 A/87 and 15142 B/87, its purpose being to effect initial separation of the semolina fractions from the bran fractions by the impact of the particles with each other and against suitable surfaces of break-up rings, against which the material, entrained by air stream, is projected by distributor discs.

The fourth semifinished products leave through the exit 29 to reach the plansifter 30, where they undergo screening to provide finished products, ie fairly fine flour, through the exit 32 and semifinished products through the exit 31.

The third semifinished products leaving the exit 20 of the unit 18 are processed in the separation roll mill 37, where the semolina fractions are separated from the bran, and are then screened in the plansifter 39. The bran leaves through the exit 40 of the plansifter 39, passes through the centrifugal impact mill 42 and is fed to the exit 43, while fifth semifinished products are obtained through the exit 41 of the plansifter 39, to be treated in the purifier 44 together with the semifinished products leaving the exit 31 of the plansifter 30.

The products screened by the purifier 44 are subjected to particle size reduction in the reduction roll mill 46, to be then fed to the exit 47 as finished products in the form of very fine flour.

The described milling process and plant have various advantages over the traditional, in particular because they enable numerous roll mills, in particular the breaking mills, and various plansifters and purifiers to be eliminated.

This results in a reduction in plant costs and also a lowering of production costs by virtue of the shorter production cycle, the resultant energy saving and the reduced maintenance required.

All this is accompanied by an improvement in product flour quality, in particular with regard to absorption power and the particle size, which is regular and uniform.

The bran is also "cleaner" because it is free of starchy fractions and is drier, so that its storage and preservation are facilitated.

Claims

1. A process for milling cereals such as wheat and maize, comprising a breaking operation on the crude products in the form of grains, to obtain first semifinished products and first finished products, the process being characterised by comprising at least one impact milling operation to reduce the particle size of said first semifinished products, at least one pneumatic separation operation for separating the components of said first semifinished products on the basis of their specific gravity to obtain at least second semifinished products, and at least one further milling operation to reduce the particle size of said second semifinished products to obtain at least second finished products.

2. A process as claimed in claim 1, characterised by comprising two pneumatic separation operations for separating the components of said first semifinished products on the basis of their specific gravity to obtain second and third semifinished products.

3. A process as claimed in claim 1, characterised in that said further milling operation comprises impact milling to reduce the particle size of said second semifinished products and obtain fourth semifinished products.

4. A process as claimed in claim 1, characterised by also comprising four further milling operations, the first to reduce the particle size of said second semifinished products to obtain third finished products, the second to reduce the particle size of said third semifinished products to obtain fifth semifinished products, the third to reduce the particle size of said fifth semifinished products to obtain fourth finished products, and the fourth to reduce the particle size of said fourth and fifth semifinished products to obtain fifth finished products.

5. A process as claimed in claims 1 to 4, characterised by also comprising screening and classification operations on said first, second, fourth and fifth semifinished products, based on the size of their components.

6. A process as claimed in claims 1 to 4, characterised by also comprising screening and classification operations on said second, fourth and fifth semifinished products, based on the size and specific gravity of their components.

7. A plant for milling cereals such as wheat and maize, comprising a breaking roll mill (11) for the crude products in the form of grains, to provide first semifinished products and first finished products, the plant being characterised by comprising at least one centrifugal impact mill (17) arranged to reduce the particle size of said first semifinished products, and at least one pneumatic separator (18) arranged to divide the components of said first

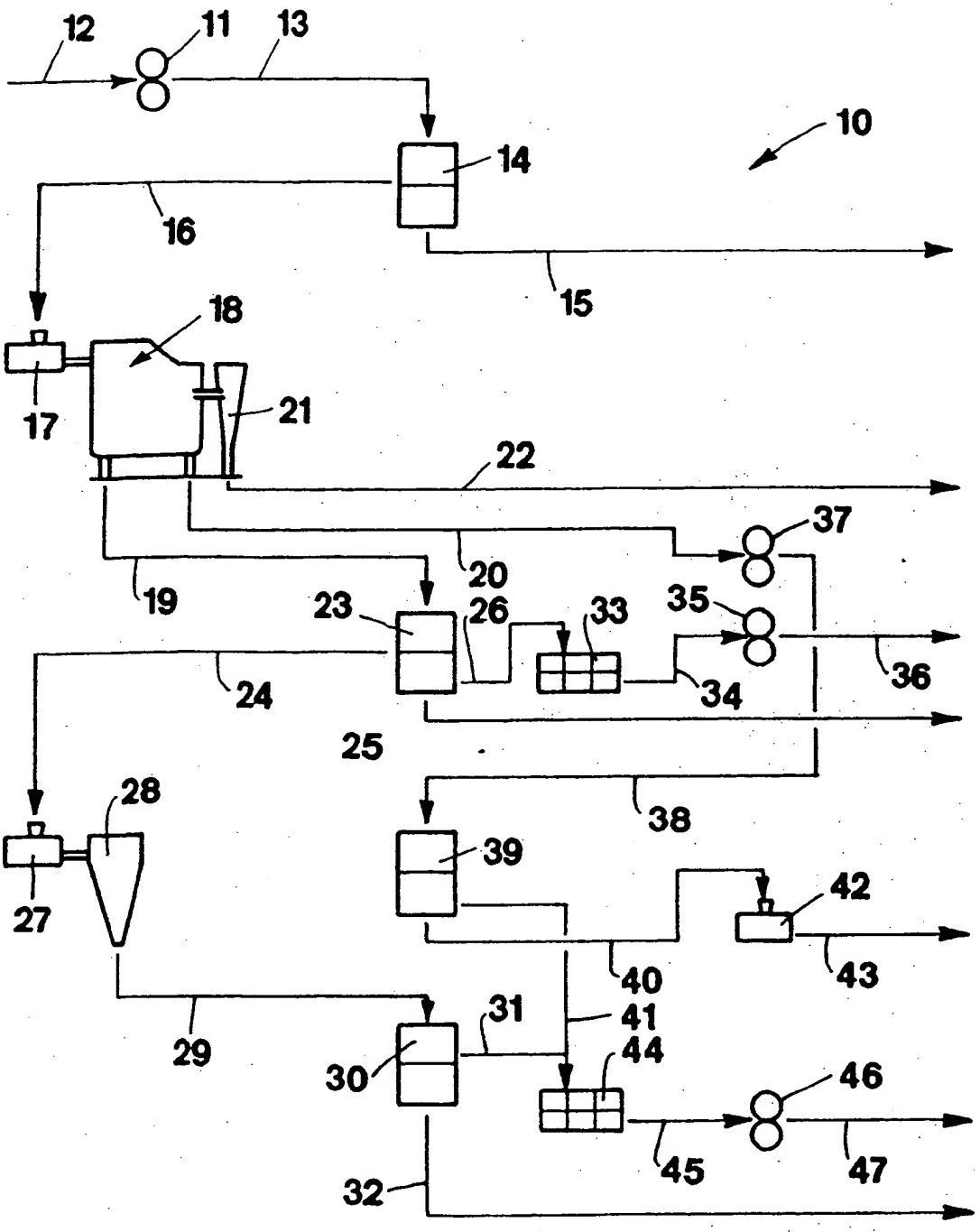
semifinished products on the basis of their specific gravity, to obtain at least second semifinished products, the plant also comprising at least one further mill (27) arranged to reduce the particle size of said second semifinished products, to provide at least second finished products.

8. A plant as claimed in claim 7, characterised by comprising two pneumatic separators (18) arranged to divide the components of said first semifinished products to provide second and third semifinished products.

9. A plant as claimed in claim 7, characterised in that said mill (27) is of centrifugal impact type arranged to reduce the particle size of said second semifinished products, to provide fourth semifinished products.

10. A plant as claimed in claims 7 to 9, characterised by also comprising four further mills, namely a roll mill (35) arranged to reduce the particle size of said second semifinished products to provide third finished products, a roll mill (37) arranged to reduce the particle size of said third semifinished products to provide fifth semifinished products,a centrifugal impact mill (42) arranged to reduce the particle size of said fifth semifinished products to provide fourth finished products, and a roll mill (46) arranged to reduce the particle size of said fourth and fifth semifinished products to provide fifth finished products.

11. A plant as claimed in claims 7 to 10, characterised by also comprising purifiers (33, 44) arranged to screen and classify said second, fourth and fifth semifinished products.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